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Clicking Instead of Speaking: The Impact of Students' Communication Apprehension on Their Evaluation of Mediated Participation and Learning in the Basic Course

Katherine J. Denker

INTRODUCTION

Calls from every source, from students to national agencies, focus on the need to transform college classrooms into spaces of engagement and participation including the basic communication course. Researchers have noted that across the board, participation in college classrooms is limited and a cause for concern (Petress, 2001). However, for students regulated to large lecture lab sections of the basic course this lack of participation is “exacerbated in the large lecture sections, as the distance between the instructor and students is increased both physically and interpersonally” (Denker, 2013, p.51). Though the number of large lecture lab sections is not as high as in past decades (Morreale, Worley, & Hugenberg, 2010), with the current state of higher education, the possibility for expansion and return to this format is clear (Tierney, 2011). Large lecture sections have been noted for leaving students as passive observers rather than engaged participants, as they watch a faculty member who seems removed both physically and affectively (Mayer et al, 2009).

Limited participation in large lecture sections of the basic course is even more problematic considering stu-

dents who experience communication apprehension. In working to engage students and help them develop as speakers, one of the largest roadblocks in the basic public speaking courses is limited participation, which is often tied to students' communication apprehension (McCroskey, 1976), and a profound impact on classroom interactions (Bippus & Young, 2000). Reticent students often work on "making themselves inconspicuous," and even withdraw from required courses (Bowers, 1986). One easy venue for students to become inconspicuous is the large lecture sections of the basic course where participation makes individuals stand out.

As participation is central to the basic communication course, it is imperative that instructors work to engage all students and one possibility for increasing interaction is through the use of Student Response Systems. Researchers have argued that Student Response Systems (SRS) or clickers are one of the most promising technologies in transforming the classroom (Roschelle, Penuel, & Abrahamson, 2004) and have linked SRS to strong outcomes like increased learning, engagement, and students' perceptions of educational value (e.g., Hall, Colier, Thomas, & Hilgers, 2005; Preszler, Dawe, Schuster, & Shuster, 2007). Though researchers have started to examine the use of these systems in communication classrooms (Denker, 2013), what we know about SRS in the basic course is limited.

Students comment that the anonymity of clicker responses encourages their participation and removes some of the pressure inherent in other forms of response (e.g., Bruff, 2009; Guthrie & Carlin, 2004). Additionally, SRS protect against silencing, as marginal opinions are easier to express (Bruff, 2009). Further, shy students

report both more negative affect in classrooms that require verbal responses or hand raising and higher preference for the use of SRS (Stowell, Oldham, & Bennett, 2010). However, in measuring the impact of clicker use on “shy” students, researchers have used measures linked to shyness such as anxiety and shame (Stowell et al., 2010) rather than more direct measures. Though helpful, indirect measures do not allow for an accurate of a picture of the relationships at play. As technology continues to develop as an important opportunity for augmenting basic course instruction, researchers need to understand how the dynamic of the basic communication course shapes participation, students’ willingness to engage in interactions based on their communication apprehension, and how these relationships impact learning.

LITERATURE REVIEW

Student Participation in the Basic Communication Course Classroom

Morreale, Worley, and Hugenberg, (2010) noted that ten percent of basic communication courses are still run through large lecture lab formats. As concerns have been linked to large lecture class format, like the large lecture lab set up of many basic course classes (e.g., Draper & Brown, 2004; Mollborn & Hoekstra, 2010), one common issue is the question of engagement, and as an extension of this, participation. From feeling affectively distant to periods of passivity (Denker, 2013; Mayer et al., 2009), leaving large lecture sections of the basic

course unexamined can create harmful outcomes for students.

Student engagement is tied to student success (Kuh, 2007). Further engagement, often conceptualized through participation in the basic course, is one of the best predictors of learning (Carini, Kuh, & Klein, 2006; Davies & Graff, 2005). Moreover, participation offers many advantages beyond cognitive gains, including enhanced classroom climate, improved students' self-esteem, and increased motivation (McKeachie, 1970; Meyer & Hunt, 2011). Psychomotor learning, such as developing communication skills, has also been associated with participation (Dallimore, Hertenstein, & Platt, 2008). Although more limited in large lecture sections of the basic course due to student perceptions and time constraints, interaction provided in discussion is the most prevalent and useful approach for fostering critical reflection (Wade, 1994). One concerning finding is how infrequently students participate in class (Rocca, 2010). Researchers have noted that only around 25% of students participate in class, especially in larger classrooms (Karp & Yoels, 1976; Nunn, 1996). Though this limited participation might have a variety of causes beyond the student, it is important for researchers to examine variables that impact participation and look for ways to further engage students in the basic course classroom.

Given the clear importance of participation, it is imperative to note that some variables impact students' willingness to engage in the classroom and participate. Multiple scholars have noted that students' self-perceptions also impact their classroom interactions (Fassinger, 1995a, 1995b; Karp & Yoels, 1976; Wade, 1994;

Weaver & Qi, 2005). Additionally, students' traits such as communication apprehension (Bippus & Young, 2000), have a profound impact on classroom interactions as some students are motivated to engage whereas others work to be inconspicuous (Bowers, 1986). Students can easily become inconspicuous especially in the large lecture sections of the basic course classroom where participation makes individuals stand out.

Participation is also limited by classroom-based factors, such as class size, seating arrangements, and timing (Fassinger, 1995b; Myers et al., 2009). Furthermore, students' perceptions of a comfortable classroom, based on prior experiences and environmental factors, impact their willingness to communicate (Auster & MacRone, 1994). This suggests that students with previous lecture experience will participate more in lecture settings (Rocca, 2010). Additionally, having talkative peers in the class can create a "consolidation of responsibility;" and thus remove individual responsibility, allowing some students to remain silent (Fassinger, 1995a; Howard, Short, & Clark, 1996; Karp & Yoels, 1976). Course policies also impact participation (Junn, 1994), such as graded participation, the quality of class discussions (Dallimore, Hertenstein, & Platt, 2004), and active learning strategies (Shaver, 2010). With the limitations in participation linked to both student and classroom traits, researchers must continue explore solutions. One option for increasing participation in the basic communication course is SRS.

Student Response Systems

As communication scholars have suggested, limiting our understanding of participation to spoken interactions alone is problematic (Meyer, 2007, 2010). Moreover, as communication apprehension impacts participation, instructors need new tools to include all voices (Bippus & Young, 2000). Instructional technology can be one of those tools. One form of technology, SRS, have grown in popularity through recent technological advancements and increased media exposure (Karaman, 2011; Winograd & Cheesman, 2007). Student response systems, or SRS, are classroom polling systems that use individual remotes or “clickers” that send infrared or radio frequencies to the instructors’ receiver. These allow instructors to both record and assess students’ responses in the classroom in real time (see Denker, 2013). Though SRS use is still largely limited to “early adopters,” researchers have started to examine these systems (Emenike & Holme, 2012). There is an abundance of literature reviews that offer a current understanding of SRS¹ (e.g., Fies & Marshall, 2006; White, Syncox, & Alters, 2011; Winograd & Cheesman, 2007). However, the majority of the scholarship on SRS still only offers implementation advice, be it framed from pedagogical theory or simply a discussion of the process (e.g., King, 2011) rather than evaluation. As we move to incorporate tools to build learning centered classrooms, engagements should increase, however those in charge

¹ As past articles have already established the history of student response systems, this will not be presented here. Rather, the reader should return to these sources for more information.

of the basic course have a responsibility to assess the tools incorporated into their pedagogy.

In reviewing the benefits of SRS, the incorporation of SRS has been linked to students' cognitive gains. Researchers started to examine the impact on students' cognitive gains through self reports and noted students report that clickers enhance their learning (Ioannou & Artino, 2010). Moreover, Denker (2013) found that clickers impact perceptions of both cognitive and affective learning in the basic communication course classroom. In exploring actual instructional outcomes, Gauci, Dantas, Williams, and Kemm (2009) found clicker technologies significantly impacted both midterm and final exam score; however, these result were limited to the psychology classroom. As the basic communication course has uniquely different goals, it is important to test for these same impacts on instructional outcomes.

Other benefits of SRS have been noted including: feedback, engagement, anonymity, and increased metacognitive awareness (e.g., Bruff, 2009; Denker, 2013; Hoekstra, 2008; Ioannou & Artino, 2010; Preszler et al., 2007). Students comment that the anonymity of clicker responses encourages participation and removes group-think or peer pressure inherent in other forms of response (e.g., Bruff, 2009; Guthrie & Carlin, 2004). Additionally, SRS guard against silencing in the classroom, as marginal opinions are easier to express (Bruff, 2009), leading to a more supportive climate (Winograd & Cheesman, 2007). These findings are further supported by research noting that shy students both report more negative affect in classrooms that require hand raising and greater preference for SRS (Stowell et al., 2010), which can decrease "performance avoidance goals"

(Roschelle et al., 2004, p. 5). These findings echo the work of Beckert, Fauth, and Olsen (2009) who noted that students who self-reported a lower likelihood of engaging in verbal comments also reported high satisfaction with clickers. This satisfaction might be due to the option for mediated rather than direct communication. However, in exploring the needs of students that are engaging more with clickers, our understanding is limited if we focus only on roughly constructed concepts like Stowell et al., (2010) measure of shyness, evaluated through measures of anxiety and shame, which they argue are overlapping. Some of the limitations in measuring shyness could be linked to the lack of a clear conceptual definition (McCroskey & Richmond, 1982). As imprecise measures can limit our understanding, researchers examining the basic communication course should work to build a greater understanding of “shy” students through more established means.

Further, it is concerning to note that the understanding of SRS in the basic course and the field of instructional communication is very limited. Only two published pieces encourage the use of this technology in the classroom (Barrett, Bornsen, Erickson, Markey, & Spiering, 2005; Winograd & Cheesman, 2007), and two papers explore the positive impact of SRS on perceived learning and engagement in the classroom (Denker, 2013; Trees & Jackson, 2007). In exploring basic communication courses, Morreale et al. (2010) acknowledged that the use of technology is one of the most significant changes over time; however, communication research fails to offer a full understanding of how one important technology—SRS—is utilized in our classrooms, and further how these technologies offer assistance for

meeting our students' needs, such as those who are shy or those with high communication apprehension.

Communication Apprehension

Reconceptualizing shyness from a communicative standpoint leads us to the construct of trait—based communication apprehension (CA). CA is one of the most researched phenomena in the field of instructional communication (Honeycutt, Choi, & DeBerry, 2009). McCroskey and Richmond (1982) noted that shyness and CA are correlated constructs that can be understood as forming a “genus-species relationship” (p. 460). The genus is shyness, and CA exists as the species, the “tendency to behave in a shy manner because of fear or anxiety” (p. 461). However, with the noted problems in measuring shyness (McCroskey & Richmond, 1982), and the limitations in measures apparent in Stowell et al., (2010), it is appropriate to move this exploration to the species' level and see how students' traits of CA impact individuals' reception of mediated communication in the classroom via clickers, and if this form of mediated communication improves learning outcomes in the basic course.

Communication apprehension has strong implications on students' communication in the basic course. As McCroskey, Richmond, and McCroskey (2002) noted:

Students who do not talk much in the classroom (are apprehensive, shy, less willing to communicate, and/or see themselves as less communicatively competent) are evaluated less positively by their teachers, achieve less on teacher made and standardized tests, and develop less positive affect toward the content of

classes, their teachers (particularly those who demand participation or formal presentations), and school in general (p. 386).

As early research has noted, students with high trait CA will often avoid interactions in the classroom (McCroskey, 1977), which results in an overall decrease in both the amount and quality of interactions between teachers and students (Jordan & Powers, 2007). Apprehension also impacts how students with high CA react to in-class discussion, as they have more negative attitudes toward classes with oral discussions. Furthermore, high CA students devalued communication with peers or the instructor as important aspects of the course when asked about engagement (Bippus & Young, 2000). Additionally, offering tools for engagement is important as students with high CA had less motivation to participate, accomplish tasks, or build relationships with instructors (Jordan & Powers, 2007). One common decision for highly apprehensive students is to avoid classes that would increase anxiety, such as the basic public speaking course (McCroskey, 1977).

Communication apprehension also has significant implications for students' academic success. For students with high CA, they average a 20% decrease in recall when there was an anticipated communication interaction (Booth-Butterfield, 1988). This suggests that when students anticipate an instructor asking for oral responses, their ability greatly decreases. Early research noted highly apprehensive students report both lower test scores and lower GPAs (McCroskey, 1977). This same significant negative relationship between CA and cognitive learning was found in a meta-analysis (Bourhis & Allen, 1992). Additionally, students with

high CA reported lower affect for their instructor and perceived lower levels of learning, thus possibly impacting evaluations of affective learning (Allen, Long, O'Mara & Judd, 2008). As students with high CA possess lower amounts of motivation to participate in class (McCroskey, 1977), it is understandable that these students would be less inclined to verbally interact. As participation has evolved, extending an understanding of how CA impacts participation in the classroom via meditated means can help instructors better understand and assist students' diverse needs.

Summary and Research Questions

Researchers have established classroom participation as important, and further, as problematic when working to engage students with high levels of communication apprehension (Bippus & Young, 2000). As Meyer (2010) argues, "given pedagogical trends in education that emphasize a student-centered classroom environment in which participation is highly encouraged and even tied to a student's grade, the relationship between speech and silence in the classroom ought to be more carefully examined" (p. 5). Moreover, instructors have an ethical obligation to help students become more comfortable with participating (Petress, 2001), especially in the basic communication course. Researchers have long noted that many students sit in classrooms unengaged (Karp & Yoels, 1976; Nunn, 1996). Moreover, individuals with high CA, approximately 20% of students (Honeycutt et al., 2009), are less likely to take or enjoy communication courses (McCroskey, 1977). SRS have been noted as one of the most promising tech-

nologies for transforming classrooms (Roschelle et al., 2004) and are linked to learning and increased educational value (Preszler et al., 2007). Yet, what we know about SRS is limited, specifically how they can assist shy (Stowell et al., 2010) or apprehensive students, and we must justify the technology that we require our students to use (Hwang & Wolfe, 2010). This study assesses how communication apprehension and SRS impact learning and engagement through the following research questions:

- RQ1: How does students' communication apprehension impact their evaluation of student response systems?
- RQ2: How do student response systems impact learning?
- RQ3a: How does students' communication apprehension impact participation in the classroom?
- RQ3b: How is the relationship between communication apprehension and participation mediated by clickers?
- RQ4a: How does students' communication apprehension impact their evaluation of learning?
- RQ4b: How is the relationship between communication apprehension and learning mediated by clickers?

METHODS

Participants

Participants were recruited from three sections of a required large lecture and lab-based basic public speak-

ing course at a midsized Midwest state university, all facilitated by the same instructor. As this class is required of all students at the university, it is thus representative of the university population. Students listened to an IRB-approved recruitment script and were directed to a website containing the consent information and survey. In this class, SRS were utilized every period for formative assessment of topics just covered, review of prior topics from both the large lecture and lab sections, to allow students to express their opinions, and also as a starting point for discussion.

In total, 684 students completed the survey. Of those, 68% were freshman (467), 21% sophomores (145), 7% juniors (49), and 3% seniors (20). Three students declined to report. The majority of the participants were traditional college-aged students, between 18 and 22 years old (98% or 671). Ten others were between 23-30 years old, and one was 41+ years old. Two declined to report. 456 students were female (67%), 225 male (33%), and three declined to report. In terms of class performance, 111 students reported that their grade in the class was lower than that in other classes, 428 stated that it was similar, and 142 reported higher grades. Three declined to report. When asked about their experience with clickers, only slightly over a third reported not having other classes that utilized the technology (35% or 240). For students who had taken other classes utilizing SRS, 30% (n=203) of the participants reported taking one other class with clickers, 21% two classes (n=144), 10% three classes (n=70), and 3% four to six courses (n=24).

Procedures and Data Collection

Over halfway through the semester, a recruitment script was read to all large lecture sections of the basic communication course, informing students of the voluntary nature of the assessment research, the minimal extra credit points offered, and the website at which they could find both more information and a link to the online survey. Data was gathered well into the semester as past researchers have noted that students' perceptions of technology significantly change over time (Lin & Rivera-Sanchez, 2012). When accessing the online survey, participants first encountered the IRB-approved consent information, which included consenting to the use of their SRS scores, exam scores (both multiple choice midterm and final exams), scores on pre- and post-term assessment of CA, and their responses to survey questions. The SurveyMonkey website was utilized for data collection, as it has been shown to be effective in eliminating the chance of data entry error (Henson & Denker, 2009; Morreale et al., 2010). Surveys were stripped of identifying data before they were entered into SPSS to protect participants.

Students completed the personal report of communication apprehension (PRCA-24) during the first two weeks of class and also during the last two weeks of class as part of the ongoing course assessment. Both assessments were completed via SurveyMonkey.com. As students complete these measures, they reported both their name and their lab instructor's to aid in data matching. CA was evaluated based on McCroskey's (1982) PRCA-24, which has reported an overall alpha ranging from .93 to .95, with "reliability estimates for the individual composites are only slightly lower" (Ru-

bin, Palmgreen & Sypher, 1994, p. 293). Items in this scale include "I dislike participating in group discussions," "I am afraid to express myself in meetings," "While participating in a conversation with a new acquaintance, I feel very nervous," and "My thoughts become confused and jumbled when I am giving a speech." CA was examined via sub scale scores in the research questions as communication apprehension may vary across contexts (Richmond & McCroskey, 1998). In this study, reliabilities ranged for the scales and subscales in the pre and post measures from .85 to .95 and the average scores for the PRCA-24 was 65.64, suggesting that the sample included those with marginally higher CA, as McCroskey suggests a mean of around 65.6. Looking at the assessment scores on the PRCA-24 completed by all students in the class that semester, the mean was 65.19 but was not significantly different from the mean of the sample group, which suggests that those that chose to complete the study were average students. The PRCA-24 was selected as McCroskey (1984) argued it is a trait measure, which should most closely link to stable personality traits like shyness.

Additionally, SRS were used in every large lecture class as a means of reviewing past material and also assessing students' understanding. SRS questions are multiple choice questions that reflect course content both for evaluating students' understanding of the material as well as starting discussions on course topics. Students received points each week for their responses to questions asked. Additionally, students were able to earn more points during review sessions for correct responses. This data was then matched with students who voluntarily consented to participate in the research

study. Clicker scores were evaluated by a sum score of the students' points earned through the semester.

The first portion of the online survey asked questions about students' use and perceptions of SRS developed by Jackson and Trees (2003), Trees and Jackson (2007), Draper and Brown (2004), and the present researcher. These questions included not only evaluations of the SRS, but also how students preferred to participate in classes. Trees and Jackson's (2007) Desirable Learning Process (DLP) scale was originally composed of five items focusing on students' perceptions of learning processes with a reliability of $\alpha = .86$. Trees and Jackson's (2007) Classroom Involvement/Engagement (CIE) scale was originally composed of six items focusing on students' perceptions of their ability to be an active, engaged participant and their feelings about the classroom (e.g., it felt more like a small class), with a reliability of $\alpha = .78$. The current study reconstructed these two scales in order to achieve acceptable reliability. The clicker learning scale was comprised of the original items as Trees and Jackson (2007) intended (reliability in the current study was $\alpha = .801$). Questions asked students to agree or disagree on a continuum with statements including "By using my clicker in this class I got feedback on my understanding of classroom material." The clicker engagement scale was composed of four items from the CIE scale and four additional questions (reliability in the current study was $\alpha = .759$). Questions included statements like "The use of clickers in this class helped my experience in this class to be more like the experience of a small class."

In addition to questions assessing students' perceptions of clicker use, students completed other related

measures to examine the research questions. Participation was measured utilizing an abbreviated form of Fassinger's (1995b) participation scale to increase reliability; this scale has obtained a reliability coefficient of .92 (Goodboy & Myers, 2008). In this study, an alpha of .88 was obtained. Questions on this scale included items such as "I contribute to class." and "I express personal opinions." Next, given that Schmidt (2011) called future researchers to employ students' own evaluations of learning, in addition to exam scores, this study assessed cognitive learning through Richmond, McCroskey, Kearney, and Plax's (1987) learning loss scale, where students report their own learning by responding to two questions: how much they perceived that they learned in the class, and how much they would have learned with the ideal instructor. Though this scale has been not without criticism due to its dependence on students perceptions and lacking ecological validity (Metts, Sprecher, & Cupach, 1991; Hess, Smythe, & Com 451, 2001), the Learning Loss scores are the most prevalent measure of cognitive learning in communication education research since the construction of the scale (Chesebro & McCroskey, 2000). Further, Anderson's (1979) affective learning scale was used to measure students' affective learning in the classroom. Sub scales scores from this measure were used so that the individual impact of each area of affective learning would be apparent. This scale has previously reported alphas from .86 to .98 (Rubin et al., 1994), and in this study, the subscales resulted in alphas ranging from .81 to .92. Items on this scale rate the behaviors recommended in the class, the course content, course instructor, likelihood of enrolling in a similar course and engaging in the

behaviors recommended in the course on a series of semantic differentials. Finally, students completed demographic information including how many courses they had taken that used clickers and their perception of their current course performance. After removing all identifying information, the data were stored on a password protected computer.

Data Analysis

Correlations were run to examine the possible relationships. Once initial relationships were apparent and testing would be appropriate based on correlations and test for collinearity, RQ1, RQ2, RQ3a and RQ4a were explored with regressions. To best answer RQ3b and RQ4b, a path diagram was used as it allows researchers to examine direct and indirect effects of variables. Path analysis, a form of structural equation modeling that is used in instructional communication research, provides insight into direct relationship between a larger network of variables (see Finn & Schrodt, 2012; Frymier, 1994; Weber, Martin, & Myers, 2011). Based on the reviewed literature and research questions, a diagram was hypothesized. From there, path coefficients, a form of regression, were calculated. Path coefficients were calculated using AMOS version 16 with missing data for a participant was estimated using the AMOS's "estimate values and intercepts" option. Goodness of fit was tested using multiple test statistics including chi-square, root mean square error approximation (RMSEA), normed fit index (NFI), and the comparative fit index (CFI). After evaluating the hypothesized model, two subsequent models were tested to arrive at

the model that most accurately reflected the relationships present in the data.

RESULTS

The first research question examined how students' CA impacts student evaluations of SRS. In examining the interactions between the clicker participation and learning scale, correlations were first run to establish initial relationships. CA scores were examined via subscale scores in the research questions as communication apprehension may vary across contexts (Richmond & McCroskey, 1998). As these relationships were significant, stepwise regressions were run. In exploring students' perceptions of clicker engagement, PrePRCA-24 group and public speaking scores significantly predicted their views of clicker engagement, $F(2, 592) = 8.308$, $p < 0.001$, $R^2 = 0.027$, and adjusted $R^2 = 0.024$. Exploring the individual relationships between clicker engagement and CA, both the PrePRCA-24 Public Speaking scores ($t = 3.004$, $p = 0.003$, with a standardized coefficient $b = 0.132$) and the PrePRCA-24 Group scores ($t = -3.707$, $p < .001$, with a standardized coefficient $b = -0.163$) significantly predicted students' perceptions of clicker engagement. Additionally, PrePRCA Public Speaking scores significantly predicted students' perceptions of clicker learning, $F(1, 596) = 5.972$, $p = 0.015$, $R^2 = 0.010$, and adjusted $R^2 = 0.008$.

The second research question explored the relationship between SRS and learning. Both scores on the clicker engagement scale and clicker learning scale were correlated with all measures of affective learning and learning loss. Additionally, the clicker learning scale

was correlated with both scores on the final and midterm. Students' iClicker scores for the semester were also correlated with both final exam scores and midterm exam scores. Based on the significant correlations, regression analyses were run. In exploring students' midterm exam scores, both iClicker and Clicker Learning scores significantly predicted their midterm scores, $F(2, 655) = 26.831$, $p < 0.001$, $R^2 = 0.076$, and adjusted $R^2 = 0.073$. Exploring the individual relationships between the midterm and SRS, both the iClicker scores ($t = 6.281$, $p < .001$, with a standardized coefficient $b = 0.236$) and the Clicker Learning scores ($t = 3.360$, $p = .001$, with a standardized coefficient $b = 0.126$) significantly predicted students' midterm scores. Likewise, the final exam scores were also significantly predicted by both iClicker and Clicker Learning scores, $F(2, 635) = 35.222$, $p < 0.001$, $R^2 = 0.100$, and adjusted $R^2 = 0.097$. Exploring the individual relationships between the final and SRS, both the iClicker scores ($t = 7.455$, $p < .001$, with a standardized coefficient $b = 0.281$) and the Clicker Learning scores ($t = 3.433$, $p = .001$, with a standardized coefficient $b = 0.129$) significantly predicted students' final scores. The final measure of cognitive learning, learning loss was significantly predicted by both Clicker Learning and Clicker Engagement, $F(2, 644) = 19.194$, $p < 0.001$, $R^2 = 0.056$, and adjusted $R^2 = 0.053$. Exploring the individual relationships between learning loss and SRS, both the Clicker Engagement scores ($t = -3.130$, $p = .002$, with a standardized coefficient $b = -0.153$) and the Clicker Learning scores ($t = -2.230$, $p = .026$, with a standardized coefficient $b = -0.109$) significantly predicted students' midterm scores.

In turning to measures of affective learning, all sub scores of the scale were significantly predicted by students' perceptions of clicker engagement and clicker learning. The first measure of affective learning, perception of the recommended behaviors, was significantly predicted by both Clicker Learning and Engagement, $F(2, 639) = 73.834$, $p < 0.001$, $R^2 = 0.188$, and adjusted $R^2 = 0.185$. Individually, both the Clicker Engagement scores ($t = 7.053$, $p < .001$, with a standardized coefficient $b = 0.322$) and the Clicker Learning scores ($t = 3.318$, $p = .001$, with a standardized coefficient $b = 0.152$) significantly predicted students' scores on the first affective learning scale. The second measure of affective learning, perceptions of course content, was significantly predicted by both Clicker Learning and Engagement, $F(2, 638) = 68.625$, $p < 0.001$, $R^2 = 0.177$, and adjusted $R^2 = 0.174$. Individually, both the Clicker Engagement scores ($t = 7.524$, $p < .001$, with a standardized coefficient $b = 0.346$) and the Clicker Learning scores ($t = 2.330$, $p = .020$, with a standardized coefficient $b = 0.107$) significantly predicted students' scores on the second affective learning scale. The likelihood of taking a course with similar content, the third measure of affective learning, was significantly predicted by both Clicker Learning and Engagement, $F(2, 638) = 35.379$, $p < 0.001$, $R^2 = 0.099$, and adjusted $R^2 = 0.096$. Individually, both the Clicker Engagement scores ($t = 7.942$, $p < .001$, with a standardized coefficient $b = 0.380$) and the Clicker Learning scores ($t = -2.763$, $p = .006$, with a standardized coefficient $b = -0.132$) significantly predicted students' scores on the third affective learning scale. The fourth measure of affective learning, perception of the course instructor, was significantly predicted by both Clicker

Learning and Engagement, $F(2, 643) = 61.672$, $p < 0.001$, $R^2 = 0.161$, and adjusted $R^2 = 0.158$. Individually, both the Clicker Engagement scores ($t = 5.432$, $p < .001$, with a standardized coefficient $b = 0.251$) and the Clicker Learning scores ($t = 4.174$, $p < .001$, with a standardized coefficient $b = 0.193$) significantly predicted students' scores on the fourth affective learning scale. Finally, the fifth measure of affective learning, likelihood of engaging in recommended behaviors, was significantly predicted by both Clicker Learning and Engagement, $F(2, 641) = 59.906$, $p < 0.001$, $R^2 = 0.151$, and adjusted $R^2 = 0.148$. Individually, only the Clicker Engagement scores ($t = 7.408$, $p < .001$, with a standardized coefficient $b = 0.344$) significantly predicted students' scores on the fifth affective learning scale.

Research question 3a addressed the impact of students' CA on participation in the classroom. To explore this relationship, a correlation between the measures of CA and participation was calculated, resulting in a significant correlation between the meeting subscale of CA and student's participation scores. As this relationship was significant, a stepwise regression was run. PrePRCA meeting scores significantly predicted participation, $F(1, 604) = 34.230$, $p < 0.001$, $R^2 = 0.054$, and adjusted $R^2 = 0.052$.

Research question 4a addressed how students' CA impacts their evaluation of learning. Perceptions of learning loss were significantly correlated with the interpersonal subscale of communication apprehension. PrePRCA Interpersonal Communication scores significantly predicted students' perceptions of learning loss, $F(1, 606) = 4.463$, $p = 0.035$, $R^2 = 0.007$, and adjusted $R^2 = 0.006$. Looking to affective learning, there were no sig-

nificant correlations between any of the measures of CA and the first affective learning subscale (perception of the recommended behaviors), the second affective learning subscale (perceptions of course content), the fourth affective learning subscale (perception of the course instructor), or the fifth affective learning subscale (likelihood of engaging in recommended behaviors). Students' evaluation of the third affective learning subscale (likelihood of taking a course with similar content) was correlated with the Pre term scores on the PRCA, as well as the sub scales of Group and Public Speaking. Based on the correlations, a regression was run showing that the third affective learning subscale was significantly predicted by PrePRCA-24 public speaking and group scores, $F(2, 627) = 8.435$, $p < .001$, $R^2 = 0.026$, and adjusted $R^2 = 0.023$. Exploring the individual relationships between the third affective learning subscale and CA, both the PrePRCA-24 Public Speaking scores ($t = -2.587$, $p = 0.010$, with a standardized coefficient $b = -0.110$) and the PrePRCA-24 Group scores ($t = -1.974$, $p = .049$, with a standardized coefficient $b = -0.084$) significantly predicted students' perceptions of recommended behaviors. Additionally, exploring beyond students' evaluations of their learning, turning to exam scores, there were no significant relationships between CA and the midterm or final scores.

Finally, to answer RQ 3b and RQ 4b, a path diagram was run with a sample of 684 using the "estimate values and intercepts" option in AMOS. This model was improved in terms of goodness of fit ($\chi^2_{(89)} = 3216.167$, $NFI = .223$, $CFI = .219$, $RMSEA = .227$), but was ultimately not a good fit. This suggests that variables need to be included in this path diagram that were not explored in

this study. Though the model may have lacked overall fit, it is worthwhile to discuss the significant paths as the model is representative of the most appropriate path diagram for this data. Additionally, the significant paths illustrate the conclusions drawn for both RQ2b and RQ3b. The appendix table includes the regression weights, standard error and p values for the paths.

The table also shows significant relationships for both RQ3b and RQ4b. Examining the first portion of the model, a variety of relationships illustrated the impact of CA on clickers. Students actual iClicker scores for the course were significantly predicted by Pre PRCA Interpersonal Scores (.355, $p < .001$) and Pre PRCA Public Speaking Scores (-.179, $p = .048$). The measure of Clicker Engagement was significantly predicted by both Pre PRCA Meeting scores (.137, $p < .001$) and the Pre PRCA Group scores (-.205, $p < .001$). Additionally, scores on the Clicker Learning measure were significantly predicted by multiple sub scores on the Pre PRCA-24, including Meeting (.067, $p = .010$), Interpersonal (-.068, $p = .013$), and Public Speaking (.055, $p = .031$).

In exploring the path from communication apprehension, to participation mediated by clickers, both the measure of Clicker Learning (-.144, $p = .005$) and the measure of Clicker Engagement (.403, $p < .001$) significantly predicted students perceptions of participation.

In examining the path from communication apprehension to learning mediated by clickers, there was an abundant number of significant relationships (see Appendix B). Turning first to cognitive learning, evaluated through learning loss, both Clicker Learning (-.047, $p = .006$) and Clicker Engagement (-.054, $p < .001$) significantly predicted scores on learning loss. Affective learn-

ing was examined through the sub scales associated with the Affective Learning scale which resulted in significant relationships (but directionally different) for all of the subscales. Looking at students' evaluations of the behaviors suggested in the class, the first sub scale, these scores were significantly predicted by the measures of Clicker Learning (.266, $p<.001$), Clicker Engagement (.336, $p<.001$) and students' actual iClicker scores for the semester (-.032, $p=.029$). Students evaluations of course content, the second sub scale, was significantly predicted by the measures of Clicker Learning (.157, $p=.002$), Clicker Engagement (.367, $p<.001$) and students actual iClicker scores for the semester (-.034, $p=.017$). The third sub scale, likelihood of taking a course with similar content, was significantly predicted by the measures of Clicker Learning (-.270, $p<.001$), and Clicker Engagement (.542, $p<.001$). Students' evaluations of the instructor, the fourth sub scale, was significantly predicted by the measures of Clicker Learning (.300, $p<.001$), Clicker Engagement (.227, $p<.001$) and students actual iClicker scores for the semester (-.031, $p=.037$). The fifth sub scale, students reported likelihood of engaging in behaviors suggested in the class, was significantly predicted by the measures of Clicker Learning (.116, $p=.036$), Clicker Engagement (.390, $p<.001$) and students actual iClicker scores for the semester (-.031, $p=.042$).

Finally, the last useful makers of learning in the class, the midterm and final exam scores, were significantly predicted by clicker scores. Student scores on the midterm exam could be predicted by the measures of Clicker Learning (.835, $p<.001$), Clicker Engagement (-.519, $p<.001$) and students actual iClicker scores for the

semester (.200, $p < .001$). Student scores on the final exam likewise could be predicted by the measures of Clicker Learning (.792, $p < .001$), Clicker Engagement (-.424, $p < .001$) and students actual iClicker scores (.252, $p < .001$).

DISCUSSION

The first research question looked at the impact of CA on students' evaluations of SRS. Supporting past research (Stowell et al., 2010), students with higher group CA reported greater perceptions of engagement through clickers, via the measure of clicker engagement, though the variance accounted for was minimal. Additionally, students with higher CA were more likely to report high scores on measures of clicker learning. However, it is important to note that the variance accounted for is minimal, suggesting a relationship supported by sample size rather than a true interaction. Students in the large lecture classroom might not evaluate the option of participating by, and thus the clickers themselves, as more rewarding. Honeycutt et al. (2009) argued that "experiencing CA does not automatically mean that the communication will suffer" (p. 229). It is possible that as many of the students with high CA do not feel much increased apprehension in large lectures as the norm is not participating or, as in the current study, these students get to maintain their anonymity while participating through SRS. As McCroskey, Richmond and Davis (1986) noted, situational contexts are stronger predictors of CA than trait predispositions, so it might be that the situation of participating in the

large lecture is not that anxiety-provoking as the likelihood of getting called on in a class of 300 to 600 is low.

The second research question illustrated the strong impact that clicker can have on learning. One of the most interesting results is that clicker technologies can shape actual cognitive learning outcomes, thus lending further support to findings like Gauci et al. (2009), only within the context of the basic communication course. Not only do we see about seven percent of the variance in the midterm and ten percent of the variance on the final accounted for by students' perceptions of clicker learning and actual clicker scores, but these same results were noted with perceptions of learning. Together both perceptions of clicker engagement and learning accounted for five percent of the variance in students' learning loss scores, suggesting that as students felt more involved and felt they were learning more through using clickers, this shaped how they felt about their overall learning in the classroom. Moreover, both perceptions of clicker engagement and learning accounted for between approximately ten to nineteen percent of the variance in affective learning scores, again illustrating the impact that engagement and perceived learning can have on student enjoyment of the course. These findings echo Denker (2013) results suggesting that clickers impact perceptions of learning in the communication classroom, and early work speaking to perceptions of learning in college courses (Ioannou & Armino, 2010).

Research question 3a examined how students' communication apprehension impacts participation in the classroom. Results suggest that CA has a significant but very small impact on students' participation in the

classroom. With CA accounting for just five percent of the variance at most, it is important to note that these are statistically significant, however not as practically significant as past research (e.g., Stowell et al., 2010) would suggest. Participation may not truly be impacted by communication apprehension in the same way that other scholars would assume. Part of this limited relationship might be explained by the ways students engage in participation in the classroom setting. In looking at why this limited impact on participation was seen, it could be due to the size of the class, as it was a large lecture. McCroskey et al., (2002) noted that high CA's prefer large lecture classes (p. 131), which might be due to the lack of a perceived "requirement" to participate due to the perceived anonymity in a large lecture course. While the large lecture class examined in the current study required the students to participate with the SRS, as students received minimal participation points for each class, the perceived anonymity may have still been in place.

Research question 4a examined the impact of students' communication apprehension on their evaluations of learning. Results suggest that there was a minimal impact on cognitive learning as evaluated by the learning loss scale, most likely an effect of sample size; however, students' levels of CA impacted their affective learning in relation to taking a similar course. However, this prediction accounted again for very minimal variance, around three percent, in affective learning, which might be impacted by the limited student-teacher relationship in large lecture courses. These findings support past research which notes that students with higher levels of CA have less motivation to

build relationships with their instructors (Jordan & Powers, 2007).

As both past research and the other research questions suggested relationships between clickers, CA, learning, and participation, a more complex model was examined to offer a richer understanding of the interactions. Both research questions 3b and 4b were answered through the use of modeling procedures, which better illustrate the ways in which clickers can serve as a mediating variable that can explain the relationship between CA, participation, and learning. Though the final model did not have ideal statistics, it is still the best fitting model to explain the relationships between the variables that were examined. This means that there are a variety of other variables that impact students' evaluations of clickers, participation, and learning, which makes sense as other larger proposed models, like the instructional beliefs model (Weber et al., 2011), typically offer more predictor variables to account for and explain greater variance.

When clickers were added in as a mediating variable to clarify the relationship between CA and participation, we see an interesting shift. Not only do both pre PRCA-24 scores in both the group and meeting context significantly predict students' evaluations of clicker engagement, but then in examining the path to participation, we see nearly 17% of the variance accounted for by students' evaluations of clickers. This difference in variance explained when adding in clickers suggests that the use of clickers creates a stronger impact on students' participation in large lecture courses than students' apprehension alone, as CA originally only explained 5% of the variance. These findings suggest that SRS allow for a

more student centered learning model, removing the barriers to participation. This change is noteworthy as it affirms past research that suggest that not only are SRS beneficial for participation (Bruff, 2009; Guthrie & Carlin, 2004), but also it is clear that they help mediate some of the impact that CA might otherwise have on participation as well as provide a venue to help more students engage in the large lecture classroom.

Similarly, student learning can be better explained when examined through the more complex model. In contrast to the limited results reported in RQ3a, by expanding the relationship between CA and learning mediated by clickers, the percentage of variance accounted for improves. Not only is there a clear and notable relationship between actual student scores on the clickers for the semester and exams in the class, which conceptually makes sense and echoes the results of Gauci et al.(2009), but that same strong relationship appears in examining students' evaluations of Clicker Learning, with over 16% of the variance on the final and 19% of the variance on the midterm accounted for. This suggests that when students perceive gains in learning in the large lecture basic course classroom through the use of clicker systems, these gains will then translate into actual learning gains. Further, as both students' pre PRCA-24 meeting and public speaking sub scale scores significantly predict Clicker Learning, it is imperative that instructors in the basic course examine the different contexts of students' apprehension and work with these students so we can help all students have the same chance for success in our basic course.

Turning to students' reports of learning in the basic course, both affective and cognitive learning also were

better explained through the models. Cognitive learning, as measured through the learning loss measure, was significantly predicted by both clicker learning and engagement; however, these percentages were low, which might be explained by the problematic nature of the measure (Hess et al., 2001). Yet, when turning to affective learning, it is clear that the impact of clickers is important, with variance shifting limited relationships and single digit numbers to scores in the 13 to 17% range through the model, especially when mediated by clicker engagement. Clearly, students that perceive that they are more engaged in the large lecture classroom through clickers will also report more affective learning, as engagement and participation have been linked to affective learning (Frisby & Myers, 2008). However, what is interesting is that we now see that this might especially be the case for students with higher levels of group and meeting CA as those scores significantly predicted scores on the Clicker Engagement scale. Conceptually, this makes sense as students who are less willing to speak out in class (or groups) might prefer engagement through other means. Thus, when these students are engaged, they report more favorable evaluations of the course, material, and instructor.

Practical Implications

With the knowledge that clickers can work to mediate the relationship between CA and participation as well as learning, instructors should work to incorporate student response systems into the large lecture classroom of the basic course. Moreover, in the basic course

there are some situations that might be silencing for all students, like providing peer evaluations of classmates' presentations, which might be ameliorated by offering a mediated means of participating. Not only is this an important choice for students with high CA as we see the link with participation, but even more as there are clear implications for students' learning both on performance measures and in their perceptions.

However, this advice must be offered with caution as past research has noted limited drawbacks to the SRS technology such as time and cost issues (e.g., Lundeborg et al., 2011; White et al., 2011). Moreover, as Denker (2013) noted clickers serve just as a tool in the classroom and are not the total solution. Instructors need to continue to work on both learning the technology and creating engaging and participatory classroom environments. Student response systems can provide a powerful tool for students in increasing participation and learning. Moreover, these tools can be particularly beneficial for students with high communication apprehension and at-risk populations in the large lecture sections of the basic course.

Limitations and Future Research

With the limited impact that communication apprehension had on a variety of variables, it is important to further explore this relationship and see if the results were impacted by the class in which they were collected. The public speaking class at this large Midwestern University is facilitated in a large lecture lab format, which is unique to less than ten percent of basic courses (Morreale et al., 2010). As research has noted that these very

large lectures create a unique classroom environment (Cleveland, 2002), it is possible that participants' understanding of what it meant to engage in the communication classroom was impacted by this environment. Further, as relationships between students and teachers might reflect more of a para-social relationship as our reviewer suggests, the class size could also shape students responses to affective learning. Future researchers should work to replicate this study in smaller classrooms so that a clearer understanding of CA's impact on participation and mediated participation is built as well as how other variables like affective learning are impacted. Additionally, as clickers might shift the way that students interact in classrooms, future research should also look at the ways that these changes might impact broader learning outcomes, especially in the basic communication course.

As the model in this study was the best fit to explain the relationship between the variables in question, it was acceptable. However, it is clear that there are variables missing from this model that might offer a better fit overall. Communication apprehension is not the only factor that will impact and account for variance in student learning, participation, and even engagement via mediated means. Researchers need to replicate this process in subsequent semesters while including other variables that might speak to students' evaluations of participation and learning, such as communication competence, teacher immediacy (Mottet & Richmond, 1998), learner empowerment (Frymier, Shulman, & Houser, 1996), and motivation (Gorham & Millette, 1997).

Another limitation to the study, as noted by the reviewers, might be linked to the use of volunteer sample

for this research. Though analysis of the overall population of students in the course compared to participants in this research study suggested no significant differences in CA scores, it is possible that other unforeseen differences did exist between the two groups. Therefore, it is important to note the potential limitations of volunteer samples. Past research has documented that volunteer samples tend to be students who are more successful academically (Callahan, Hojat & Gonnella, 2007), however these results were limited to medical students. Additionally, earlier researchers have noted the impact of volunteer bias as volunteers are likely to have higher self-disclosure scores as well as high social desirability scores (Hood & Back, 1971) and greater external locus of control (Cash & Janda, 1977), all which could impact the ways in which individuals respond to surveys. Future research should work to track all variables to ensure that participants in the study do not deviate in any way from the larger population.

Student response systems continue to be incorporated in communication classrooms as a means to increase student engagement and learning. Numerous studies have documented the benefits of these systems; however, some of these claims, like those that argue the benefit to shy students, have been less substantiated. The current study worked to correct this limitation and added to our understanding of SRS in the large lecture section of the Basic Communication course classroom. Students' CA was a significant predictor of their evaluation of clickers, learning, and classroom participation. However, these relationships were not as strong as expected, thus leading to limitations and suggestions for future research.

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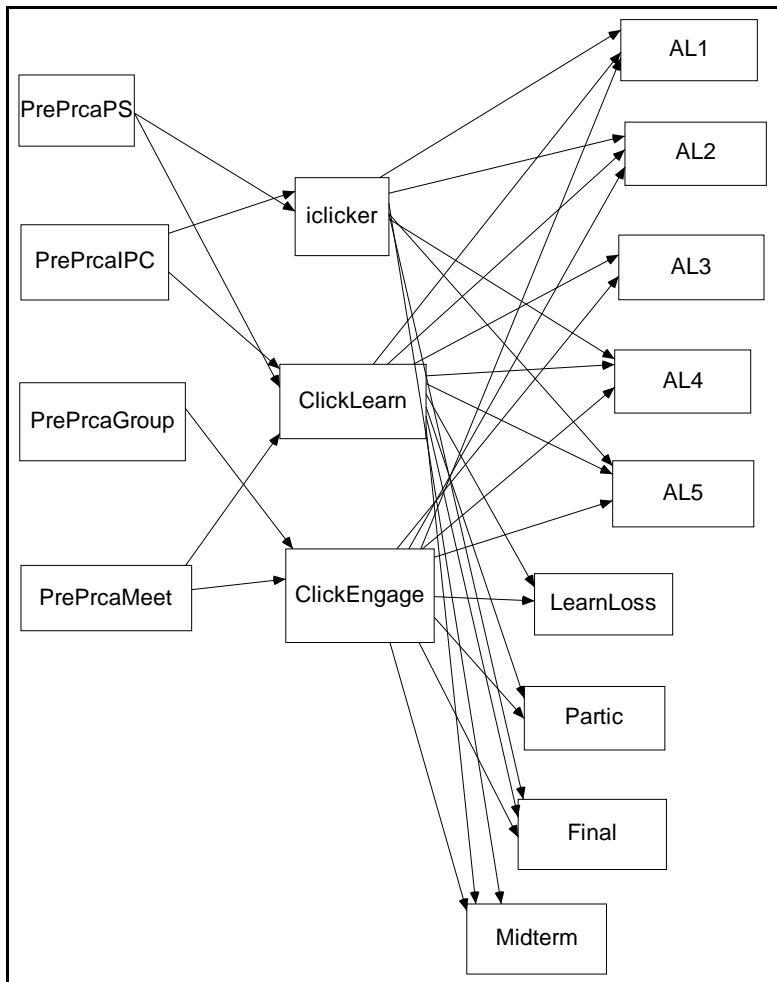
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APPENDIX A
Final Path Diagram



APPENDIX B

Standardized Regression Weights and P-Values

Path	Estimate	p value
PrePRCA Group → Clicker Engagement	-0.205	<.001
PrePRCA Meeting → Clicker Learning	0.067	0.010
PrePRCA Meeting → Clicker Engagement	0.137	<.001
PrePRCA Interpersonal → iClicker Scores	0.355	<.001
PrePRCA Interpersonal → Clicker Learning	-0.068	0.013
PrePRCA Public Speaking → iClicker Scores	-0.179	0.048
PrePRCA Public Speaking → Clicker Learning	0.055	0.031
iClicker Scores → Affective Learning1-Behaviors	-0.032	0.029
iClicker Scores → Affective Learning2-Course Content	-0.034	0.017
iClicker Scores → Affective Learning4-Instructor	-0.031	0.037
iClicker Scores → Affective Learning5-EngagingInBehav.	-0.031	0.042
iClicker Scores → Final	0.252	<.001
iClicker Scores → Midterm	0.200	<.001
Clicker Learning → Affective Learning1-Behaviors	0.266	<.001
Clicker Learning → Affective Learning2-Course Content	0.157	0.002
Clicker Learning → Affective Learning3-Similar Content	-0.270	<.001
Clicker Learning → Affective Learning4-Instructor	0.300	<.001
Clicker Learning → Affective Learning5-EngagingInBehav.	0.116	0.036
Clicker Learning → Learning Loss	-0.047	0.006
Clicker Learning → Participation	-0.144	0.005
Clicker Learning → Final	0.792	<.001
Clicker Learning → Midterm	0.835	<.001
Clicker Engagement → Affective Learning1-Behaviors	0.336	<.001
Clicker Engagement → Affective Learning2-Course Content	0.367	<.001
Clicker Engagement → Affective Learning3-Similar Content	0.542	<.001
Clicker Engagement → Affective Learning4-Instructor	0.277	<.001
Clicker Engagement → Affective Learning5-EngInBehav.	0.390	<.001
Clicker Engagement → Learning Loss	-0.054	<.001
Clicker Engagement → Participation	0.403	<.001
Clicker Engagement → Final	-0.424	<.001
Clicker Engagement → Midterm	-0.519	<.001